STATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY PETE WILSON, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SANTA ANA REGION
2010 IOWA AVENUE, SUITE 100
RIVERSIDE, CA 92507-2409
PHONE (909) 782-4130
FAX (909) 781-6288

December 11, 1995

Mr. Carl Ross
Red Eagle Properties Limited
2020 Lynx Trail
Ontario, CA 91761

FULLERTON BUSINESS PARK, 1551 EAST ORANGETHORPE AVENUE, FULLERTON

Dear Mr. Ross:

On November 1, 1995, Robert Holub and Augustine Anijielo of Board staff met with Mark Boen of Red Eagle Properties and Roger Turner regarding the above site. In September 1994, Red Eagle Properties removed two clarifiers that were present at the site and identified PCE in the soil immediately beneath one of the clarifiers. In December 1994, Converse Consultants, on behalf of Red Eagle Properties, performed a soil investigation to characterize the soil at the site. In January 1995, Converse Consultants performed an additional soil investigation. These investigations found that significant PCE concentrations were present in the shallow soil. The investigations also detected TCE to a depth near the groundwater. A report prepared by Converse Consultants stated that, based on the soil data, groundwater beneath the site had not been impacted by PCE.

As a result of the public health threat posed by the PCE in the shallow soil, Red Eagle Properties is currently remediating the shallow soil under the oversight of the Orange County Health Care Agency. Board staff reviewed the results of the soil investigations and determined that TCE, and possibly PCE, may have impacted groundwater. As a result, Board staff sent a letter dated August 9, 1995, to Red Eagle Properties. This letter stated that we did not concur that groundwater beneath the site had not been impacted, and requested that a groundwater investigation, including the installation of monitoring wells, be performed.

Based on the information obtained in the November 1, 1995, meeting, it is now our understanding that Red Eagle Properties acquired the property from the Resolution Trust Corporation in May 1994. After determining that past discharges of PCE had impacted the shallow soil, Red Eagle Properties undertook diligent efforts to mitigate those impacts by installing and operating a soil vapor extraction and treatment system. The property was then sold to the current owner in March 1995. We understand that under the terms of the sale of the property, Red Eagle Properties is continuing to operate the treatment system.

It is apparent that Red Eagle Properties did not discharge the PCE that impacted the shallow soil or the PCE or TCE that may have impacted the groundwater. It is also apparent that Red Eagle Properties did not own the property during the time that those discharges took place. Please be aware that it has not been the policy of this office to hold a former owner of a property responsible for site investigation and cleanup if the former owner was not directly involved in the initial waste discharge and if the former owner did not own the property during the time that the wastes were discharged. Considering the additional information we obtained at the November 1, 1995, meeting, we withdraw our request to Red Eagle Properties to conduct a groundwater investigation.

You also asked what the responsibilities are for a current landowner at this site. Section 13304 of the California Water Code states that the Regional Board can order any person who caused or permitted waste to be discharged into waters of the state and creates, or threatens to create, a condition of pollution or nuisance, to cleanup the waste or abate the effects thereof. If such an order was issued, the party responsible for the release of the waste would be designated as the primary responsible party and the current landowner of the property would be designated as the secondary responsible party. The primary responsible party would be required to comply with all of the terms of the order. The only time that the secondary responsible party would be required to comply with any of the terms of the order, is if the primary responsible party defaulted on the order (i.e. if the primary responsible party went bankrupt or was otherwise not able to comply with the order). Although we are unable to absolve any current property owner of responsibility for any site investigation or cleanup, considering that the soil impacts at this site have been adequately mitigated, we are not considering issuing an order requiring a groundwater investigation at this time.

If you have any questions, please contact Robert Holub at (909) 782-3298 or Augustine Anijielo at (909) 782-3292.

Sincerely,

Gerard J. Thibeault
Executive Officer

cc: Luis Lodriqueza, OCHCA

RLH/AEA:slic\msol\fullbus

SIMPLIFIED VAPOR PATHWAY EVALUATION AND INCREASED CANCER RISK ASSESSMENT CALCULATIONS

SITE NAME: Full Bus PK	DATE: 12/14/95	
94IC29	RUN #: 1,1-DCE	
ANALYSIS BY: L. L.	20' 2 lyrs	

SOIL PORE WATER

Soil gas concentration (Csg) = [Contaminant concentration in soil (Ct) / Wet weight soil moisture content (Mwet)] * Henry's Law constant (H)
(Note: When multiple soil layers are used in the flux calculation, be sure the soil characteristic values that are used below are from layer in which the contaminant (source) is located)

Variables	Units	Inputs	Outputs
(Ct) Contaminant conc. in soil (site data) (IF NOT USING THE SOIL PORE WATER COMPONENT, INPUT 0)	mg/kg	3.1	
Wet weight soil moisture content (Mwet) = Mdry / 1 + Mdry (calculated)	gram/gram		1.83E-01
Mwet (field data) (IF NOT USING SITE SPECIFIC DATA, INPUT 0.)	gram/gram	0	
(H) Henry's Law Constant	Dimensionless	6.15	
Soil moisture by dry weight (Mdry) = Soil moisture by volume (Ø) / Bulk density (Bd)	gram/gram		2.24E-01
(Ø) Soil moisture by volume, (See ref. #4 for default value.) (Note: 1 cm^3 water = 1 gram water)	cm^3/cm^3	0.339	
Bulk density (Bd) = Particle density (Pd) - [Pd * Total porosity (Pt)].	g/cm^3		1.51E+00
(Pd) Particle density (Use 2.65 as default value)	g/cm^3	2.65	
(Pt) Total porosity (Use ref. 4 as default)	cm^3/cm^3	0.43	
Calculated soil gas level	mg/l		1.04E+02
Calculated soil gas level	mg/cm^3		1.04E-01

DCE = 2.5E-07
TCE = 1.7E-08
PCE = 3.0E-08
Total Risk = 2.9E-07

DISSOLVED IN GROUNDWATER

Soil gas concentration (Csg) = Concentration in groundwater (Cw) * Henry's Law constant (H)

Variables	Units	Inputs	Outputs
(Cw) Conc. in GW (IF NOT USING DISSOLVED IN GROUNDWATER COMPONENT, INPUT 0.)	PPM		
(H) Henry's Law constant	dimensionless	6.88	
Calculated soil gas level	mg/cm^3		0.00E+00

DIRECT MEASUREMENT OF SOIL GAS

Variables	Units	Inputs	Outputs
(Csg) Contaminant soil gas conc. (IF NOT USING DIRECT MEASUREMENT COMPONENT, INPUT 0.)	mg/m^3	0	
Spreadsheet unit conversion to mg/cm^3	mg/cm^3		0.00E+00

FREE PRODUCT

Conc. of soil gas (Csg) = Vapor pressure (VP)* Mol. Wt. (MW) * Mole fraction (MF) / Universal gas constant (R) * Absolute Temp. (T)

Variables	Units	Inputs	Outputs
(VP) Vapor pressure at 20° C (IF NOT USING THE FREE PRODUCT COMPONENT, INPUT 0)	atm	0	
(MW) Molecular weight	mg/mole		
(MF) Mole fraction	dimensionless		
(R) Universal gas constant	cc-atm/mole-°k		
(T) Absolute temperature	°K		
Calculated soil gas level	mg/cm^3		0.00E+00

FLUX

Flux (F) = Measured or calculated soil gas level / Vertical length of soil layer between source and surface (or next soil layer that has a dissimilar vapor permeability) (L1) / Diffusion coefficient for soil layer (De1) L1+(L2/De2)+...(Ln/Den) (NOTE: If flux for outdoor conc. is expected to differ from indoor flux, first calc. outdoor flux and enter results below in outdoor component section, then come back and calc. indoor flux.)

Variables	Units	Inputs	Outputs
(Csg) Soil gas level (Note: Program selected the lowest non-zero Csg from spread sheet for use)	mg/cm^3		1.04E-01
(L1) Vertical length of 1st soil layer between source and surface. If only one layer, enter data here.	cm	457	
(L2) Vertical length of 2nd soil layer. (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 0.)	cm	152	
(L3) Vertical length of 3rd soil layer. (IF ONLY TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 0.)	cm	0	
(De1) Effective diffusion coefficient layer 1 = Diff. coefficient in air (Da) * (Air filled porosity layer 1 (Pa1)^3.33 / Total porosity layer 1 (Pt1)^2)	cm^2/sec		1.46E-04
(Da) Diffusion coefficient in air (See ref. 2)	cm^2/sec	0.079	
(Pa1) Air filled porosity layer 1 = (Pt1) Total porosity layer 1-(Ø1) Soil moisture by vol. layer 1	dimensionless		9.10E-02
(Pt1) Total porosity layer 1 (Use ref.4 as default)	cm^3/cm^3	0.43	
(Ø1) Soil moisture by volume, layer 1 (Use reference 4 as default)	cm^3/cm^3	0.339	
De2 = Da * (Pa2^3.33/Pt2^2)	cm^2/sec		2.89E-03
Pa2 = Pt2 - Ø2	dimensionless		2.23E-01
Pt2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	dimensionless	0.43	
Ø2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	cm^3/cm^3	0.207	
De3 = Da * (Pa3^3.33/Pt3^2)	cm^2/sec		0.00E+00
Pa3 = Pt3 - Ø3	dimensionless		0.00E+00
Pt3 (Use refer.#4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1)	dimensionless	1	
Ø3 (Use refer. #4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1.)	cm^3/cm^3	1	
(F) Flux	mg/sec-cm^2		3.27E-04

OUTDOOR AIR COMPONENT

Concentration in outdoor air (Co) = [Outdoor flux (Fo) * Downwind length of contamination (Ld)] / [Wind speed (u) * Height of box (h), e.g., height of doorway or ventilation system intake.]

Variables	Units	Inputs	Outputs
ENTER 0 IF OUTDOOR AIR COMPONENT IS NOT TO BE USED. HOWEVER, IF IT IS USED AND Fo ≠ Fi, ENTER CALCULATED Fo HERE. SEE NOTE IN FLUX SECTION.	mg/sec-m^2	0	
ENTER 1 IF Fo ≠ Fi, OR 2 IF Fo = Fi.	mg/sec-m^2	2	3.27E-04
(Ld) Down wind length of contamination	m	10	
(u) Wind speed	m/sec	0.894	
(h) Height of box	m	2.44	
(Co) Concentration in outdoor air	mg/m^3		0.00E+00

CONCENTRATION IN INDOOR AIR

Total conc. in indoor air (Ci) = Conc. in outdoor air (Co)+[Foundation attenuation factor (b) * Flux for area under building (Fu) * Area through which flux occurs (A)] / [Vol. of building (V) * Air exchange rate (E)]

Variables	Units	Inputs	Outputs
(Co) Concentration. in outdoor air	mg/m^3		0.00E+00
(b) Foundation attenuation factor	dimensionless	0.001	
(Fu) Flux for area under building	mg/sec-m^2		3.27E-04
(A) Area through which flux occurs under building	m^2	50	
(V) Volume of building	m^3	2440	
(E) Exchange rate of building air	bldg. vol./sec	0.000139	
(Ci) Total indoor air contaminant concentration	mg/m^3		4.82E-05

INTAKE (INHALATION) OF VAPOR PHASE

Intake = Indoor contaminant conc. (Ci) * Daily intake rate (IR) * Exposure time (ET) * Exposure freq. (EF) * Exposure duration (ED)/ Body weight (BW) * Averaging time (AT)

Variables	Units	Inputs	Outputs
ENTER 0 IF SOURCE IS UNDER BUILDING; ENTER 1 IF PAVED AREA DIRECTS VAPORS UNDER BUILDING.	dimensionless	0	
(Ci) Total indoor air contaminant concentration	mg/m^3		4.82E-05
(IR) Daily intake rate (See ref. 5 for default value)	m^3/day	20	
(ET) Exposure time	hrs/24 hrs	10	4.17E-01
(EF) Exposure freq. (See ref. 5 for default value)	days/yr	250	
(ED) Exposure duration (See ref. 5 for default value)	yrs	25	
(BW) Body weight (See ref. 5 for default value)	kg	70	
(AT) Averaging time	days		2.56E+04
Intake	mg/kg-day		1.40E-06

EXCESS LIFETIME RISK CALCULATION

EXCESS LIFETIME RISK = SLOPE FACTOR * UNITS OF EXPOSURE

Variables	Units	Inputs	Outputs
Carcinogenic slope factor (Potency factor)	1/mg/kg/day	0.175	
Units of exposure (Intake)	mg/kg/day	1.40E-06	
Excess Lifetime Cancer Risk	dimensionless		2.46E-07

SIMPLIFIED VAPOR PATHWAY EVALUATION AND INCREASED CANCER RISK ASSESSMENT CALCULATIONS

SITE NAME: Fullerton Bus. Park	DATE: 12/14/95
SITE ID #: 94IC29	RUN #: PCE @ 20'
ANALYSIS BY: Lodrigueza	2 layers

SOIL PORE WATER

Soil gas concentration (Csg) = [Contaminant concentration in soil (Ct) / Wet weight soil moisture content (Mwet)] * Henry's Law constant (H)
(Note: When multiple soil layers are used in the flux calculation, be sure the soil characteristic values that are used below are from layer in which the contaminant (source) is located)

Variables	Units	Inputs	Outputs
(Ct) Contaminant conc. in soil (site data) (IF NOT USING THE SOIL PORE WATER COMPONENT, INPUT 0)	mg/kg	12.8	
Wet weight soil moisture content (Mwet) = Mdry / 1 + Mdry (calculated)	gram/gram		1.83E-01
Mwet (field data) (IF NOT USING SITE SPECIFIC DATA, INPUT 0.)	gram/gram	0	
(H) Henry's Law Constant	Dimensionless	0.943	
Soil moisture by dry weight (Mdry) = Soil moisture by volume (Ø) / Bulk density (Bd)	gram/gram		2.24E-01
(Ø) Soil moisture by volume, (See ref. #4 for default value.) (Note: 1 cm^3 water = 1 gram water)	cm^3/cm^3	0.339	
Bulk density (Bd) = Particle density (Pd) - [Pd * Total porosity (Pt)].	g/cm^3		1.51E+00
(Pd) Particle density (Use 2.65 as default value)	g/cm^3	2.65	
(Pt) Total porosity (Use ref. 4 as default)	cm^3/cm^3	0.43	
Calculated soil gas level	mg/l		6.59E+01
Calculated soil gas level	mg/cm^3		6.59E-02

DISSOLVED IN GROUNDWATER

Soil gas concentration (Csg) = Concentration in groundwater (Cw) * Henry's Law constant (H)

Variables	Units	Inputs	Outputs
(Cw) Conc. in GW (IF NOT USING DISSOLVED IN GROUNDWATER COMPONENT, INPUT 0.)	PPM	0	
(H) Henry's Law constant	dimensionless		
Calculated soil gas level	mg/cm^3		0.00E+00

DIRECT MEASUREMENT OF SOIL GAS

Variables	Units	Inputs	Outputs
(Csg) Contaminant soil gas conc. (IF NOT USING DIRECT MEASUREMENT COMPONENT, INPUT 0.)	mg/m^3	0	
Spreadsheet unit conversion to mg/cm^3	mg/cm^3		0.00E+00

FREE PRODUCT

Conc. of soil gas (Csg) = Vapor pressure (VP)* Mol. Wt. (MW) * Mole fraction (MF) / Universal gas constant (R) * Absolute Temp. (T)

Variables	Units	Inputs	Outputs
(VP) Vapor pressure at 20° C (IF NOT USING THE FREE PRODUCT COMPONENT, INPUT 0)	atm	0	
(MW) Molecular weight	mg/mole		
(MF) Mole fraction	dimensionless		
(R) Universal gas constant	cc-atm/mole-°k		
(T) Absolute temperature	°K		
Calculated soil gas level	mg/cm^3		0.00E+00

FLUX

Flux (F) = Measured or calculated soil gas level / Vertical length of soil layer between source and surface (or next soil layer that has a dissimilar vapor permeability) (L1) / Diffusion coefficient for soil layer (De1) L1+(L2/De2)+...(Ln/Den) (NOTE: If flux for outdoor conc. is expected to differ from indoor flux, first calc. outdoor flux and enter results below in outdoor component section, then come back and calc. indoor flux.)

Variables	Units	Inputs	Outputs
(Csg) Soil gas level (Note: Program selected the lowest non-zero Csg from spread sheet for use)	mg/cm^3		6.59E-02
(L1) Vertical length of 1st soil layer between source and surface. If only one layer, enter data here.	cm	457	
(L2) Vertical length of 2nd soil layer. (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 0.)	cm	152	
(L3) Vertical length of 3rd soil layer. (IF ONLY TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 0.)	cm	0	
(De1) Effective diffusion coefficient layer 1 = Diff. coefficient in air (Da) * (Air filled porosity layer 1 (Pa1)^3.33 / Total porosity layer 1 (Pt1)^2)	cm^2/sec		1.33E-04
(Da) Diffusion coefficient in air (See ref. 2)	cm^2/sec	0.072	
(Pa1) Air filled porosity layer 1 = (Pt1) Total porosity layer 1-(Ø1) Soil moisture by vol. layer 1	dimensionless		9.10E-02
(Pt1) Total porosity layer 1 (Use ref.4 as default)	cm^3/cm^3	0.43	
(Ø1) Soil moisture by volume, layer 1 (Use reference 4 as default)	cm^3/cm^3	0.339	
De2 = Da * (Pa2^3.33/Pt2^2)	cm^2/sec		3.29E-03
Pa2 = Pt2 - Ø2	dimensionless		2.46E-01
Pt2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	dimensionless	0.453	
Ø2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	cm^3/cm^3	0.207	
De3 = Da * (Pa3^3.33/Pt3^2)	cm^2/sec		0.00E+00
Pa3 = Pt3 - Ø3	dimensionless		0.00E+00
Pt3 (Use refer.#4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1)	dimensionless	1	
Ø3 (Use refer. #4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1.)	cm^3/cm^3	1	
(F) Flux	mg/sec-cm^2		1.89E-04

OUTDOOR AIR COMPONENT

Concentration in outdoor air (Co) = [Outdoor flux (Fo) * Downwind length of contamination (Ld)] / [Wind speed (u) * Height of box (h), e.g., height of doorway or ventilation system intake.]

Variables	Units	Inputs	Outputs
ENTER 0 IF OUTDOOR AIR COMPONENT IS NOT TO BE USED. HOWEVER, IF IT IS USED AND Fo ≠ Fi, ENTER CALCULATED Fo HERE. SEE NOTE IN FLUX SECTION.	mg/sec-m^2	0	
ENTER 1 IF Fo ≠ Fi, OR 2 IF Fo = Fi.	mg/sec-m^2	2	1.89E-04
(Ld) Down wind length of contamination	m	1.524	
(u) Wind speed	m/sec	0.894	
(h) Height of box	m	2.44	
(Co) Concentration in outdoor air	mg/m^3		0.00E+00

CONCENTRATION IN INDOOR AIR

Total conc. in indoor air (Ci) = Conc. in outdoor air (Co)+[Foundation attenuation factor (b) * Flux for area under building (Fu) * Area through which flux occurs (A)] / [Vol. of building (V) * Air exchange rate (E)]

Variables	Units	Inputs	Outputs
(Co) Concentration. in outdoor air	mg/m^3		0.00E+00
(b) Foundation attenuation factor	dimensionless	0.001	
(Fu) Flux for area under building	mg/sec-m^2		1.89E-04
(A) Area through which flux occurs under building	m^2	50	
(V) Volume of building	m^3	2440	
(E) Exchange rate of building air	bldg. vol./sec	0.000139	
(Ci) Total indoor air contaminant concentration	mg/m^3		2.79E-05

INTAKE (INHALATION) OF VAPOR PHASE

Intake = Indoor contaminant conc. (Ci) * Daily intake rate (IR) * Exposure time (ET) * Exposure freq. (EF) * Exposure duration (ED)/ Body weight (BW) * Averaging time (AT)

Variables	Units	Inputs	Outputs
ENTER 0 IF SOURCE IS UNDER BUILDING; ENTER 1 IF PAVED AREA DIRECTS VAPORS UNDER BUILDING.	dimensionless	0	
(Ci) Total indoor air contaminant concentration	mg/m^3		2.79E-05
(IR) Daily intake rate (See ref. 5 for default value)	m^3/day	20	
(ET) Exposure time	hrs/24 hrs	10	4.17E-01
(EF) Exposure freq. (See ref. 5 for default value)	days/yr	250	
(ED) Exposure duration (See ref. 5 for default value)	yrs	25	
(BW) Body weight (See ref. 5 for default value)	kg	70	
(AT) Averaging time	days		2.56E+04
Intake	mg/kg-day		8.13E-07

EXCESS LIFETIME RISK CALCULATION

EXCESS LIFETIME RISK = SLOPE FACTOR * UNITS OF EXPOSURE

Variables	Units	Inputs	Outputs
Carcinogenic slope factor (Potency factor)	1/mg/kg/day	0.021	
Units of exposure (Intake)	mg/kg/day	8.13E-07	
Excess Lifetime Cancer Risk	dimensionless		1.71E-08

SIMPLIFIED VAPOR PATHWAY EVALUATION AND INCREASED CANCER RISK ASSESSMENT CALCULATIONS

SITE NAME: Fullerton Bus Pk	12/14/95		
SITE ID #: 94IC29	RUN #: TCE - 1		
ANALYSIS BY: L. Lodrigueza	20' 2 layers		

SOIL PORE WATER

Soil gas concentration (Csg) = [Contaminant concentration in soil (Ct) / Wet weight soil moisture content (Mwet)] * Henry's Law constant (H)
(Note: When multiple soil layers are used in the flux calculation, be sure the soil characteristic values that are used below are from layer in which the contaminant (source) is located)

Variables	Units	Inputs	Outputs
(Ct) Contaminant conc. in soil (site data) (IF NOT USING THE SOIL PORE WATER COMPONENT, INPUT 0)	mg/kg	3.4	
Wet weight soil moisture content (Mwet) = Mdry / 1 + Mdry (calculated)	gram/gram		1.25E-01
Mwet (field data) (IF NOT USING SITE SPECIFIC DATA, INPUT 0.)	gram/gram	0	
(H) Henry's Law Constant	Dimensionless	0.3657	
Soil moisture by dry weight (Mdry) = Soil moisture by volume (Ø) / Bulk density (Bd)	gram/gram		1.43E-01
(Ø) Soil moisture by volume, (See ref. #4 for default value.) (Note: 1 cm^3 water = 1 gram water)	cm^3/cm^3	0.207	
Bulk density (Bd) = Particle density (Pd) - [Pd * Total porosity (Pt)].	g/cm^3		1.45E+00
(Pd) Particle density (Use 2.65 as default value)	g/cm^3	2.65	
(Pt) Total porosity (Use ref. 4 as default)	cm^3/cm^3	0.453	
Calculated soil gas level	mg/l		9.95E+00
Calculated soil gas level	mg/cm^3		9.95E-03

DISSOLVED IN GROUNDWATER

Soil gas concentration (Csg) = Concentration in groundwater (Cw) * Henry's Law constant (H)

Variables	Units	Inputs	Outputs
(Cw) Conc. in GW (IF NOT USING DISSOLVED IN GROUNDWATER COMPONENT, INPUT 0.)	PPM	0	
(H) Henry's Law constant	dimensionless		
Calculated soil gas level	mg/cm^3		0.00E+00

DIRECT MEASUREMENT OF SOIL GAS

Variables	Units	Inputs	Outputs
(Csg) Contaminant soil gas conc. (IF NOT USING DIRECT MEASUREMENT COMPONENT, INPUT 0.)	mg/m^3	0	
Spreadsheet unit conversion to mg/cm^3	mg/cm^3		0.00E+00

FREE PRODUCT

Conc. of soil gas (Csg) = Vapor pressure (VP)* Mol. Wt. (MW) * Mole fraction (MF) / Universal gas constant (R) * Absolute Temp. (T)

Variables	Units	Inputs	Outputs
(VP) Vapor pressure at 20° C (IF NOT USING THE FREE PRODUCT COMPONENT, INPUT 0)	atm	0	
(MW) Molecular weight	mg/mole		
(MF) Mole fraction	dimensionless		
(R) Universal gas constant	cc-atm/mole-°k		
(T) Absolute temperature	°K		
Calculated soil gas level	mg/cm^3		0.00E+00

FLUX

Flux (F) = Measured or calculated soil gas level / Vertical length of soil layer between source and surface (or next soil layer that has a dissimilar vapor permeability) (L1) / Diffusion coefficient for soil layer (De1) L1+(L2/De2)+...(Ln/Den) (NOTE: If flux for outdoor conc. is expected to differ from indoor flux, first calc. outdoor flux and enter results below in outdoor component section, then come back and calc. indoor flux.)

Variables	Units	Inputs	Outputs
(Csg) Soil gas level (Note: Program selected the lowest non-zero Csg from spread sheet for use)	mg/cm^3		9.95E-03
(L1) Vertical length of 1st soil layer between source and surface. If only one layer, enter data here.	cm	457	
(L2) Vertical length of 2nd soil layer. (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 0.)	cm	152	
(L3) Vertical length of 3rd soil layer. (IF ONLY TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 0.)	cm	0	
(De1) Effective diffusion coefficient layer 1 = Diff. coefficient in air (Da) * (Air filled porosity layer 1 (Pa1)^3.33 / Total porosity layer 1 (Pt1)^2)	cm^2/sec		3.70E-03
(Da) Diffusion coefficient in air (See ref. 2)	cm^2/sec	0.081	
(Pa1) Air filled porosity layer 1 = (Pt1) Total porosity layer 1-(Ø1) Soil moisture by vol. layer 1	dimensionless		2.46E-01
(Pt1) Total porosity layer 1 (Use ref.4 as default)	cm^3/cm^3	0.453	
(Ø1) Soil moisture by volume, layer 1 (Use reference 4 as default)	cm^3/cm^3	0.207	
De2 = Da * (Pa2^3.33/Pt2^2)	cm^2/sec		8.77E-03
Pa2 = Pt2 - Ø2	dimensionless		3.12E-01
Pt2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	dimensionless	0.437	
Ø2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	cm^3/cm^3	0.125	
De3 = Da * (Pa3^3.33/Pt3^2)	cm^2/sec		0.00E+00
Pa3 = Pt3 - Ø3	dimensionless		0.00E+00
Pt3 (Use refer.#4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1)	dimensionless	1	
Ø3 (Use refer. #4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1.)	cm^3/cm^3	1	
(F) Flux	mg/sec-cm^2		7.06E-04

OUTDOOR AIR COMPONENT

Concentration in outdoor air (Co) = [Outdoor flux (Fo) * Downwind length of contamination (Ld)] / [Wind speed (u) * Height of box (h), e.g., height of doorway or ventilation system intake.]

Variables	Units	Inputs	Outputs
ENTER 0 IF OUTDOOR AIR COMPONENT IS NOT TO BE USED. HOWEVER, IF IT IS USED AND Fo ≠ Fi, ENTER CALCULATED Fo HERE. SEE NOTE IN FLUX SECTION.	mg/sec-m^2	0	
ENTER 1 IF Fo ≠ Fi, OR 2 IF Fo = Fi.	mg/sec-m^2	2	7.06E-04
(Ld) Down wind length of contamination	m	1.524	
(u) Wind speed	m/sec	0.894	
(h) Height of box	m	2.44	
(Co) Concentration in outdoor air	mg/m^3		0.00E+00

CONCENTRATION IN INDOOR AIR

Total conc. in indoor air (Ci) = Conc. in outdoor air (Co)+[Foundation attenuation factor (b) * Flux for area under building (Fu) * Area through which flux occurs (A)] / [Vol. of building (V) * Air exchange rate (E)]

Variables	Units	Inputs	Outputs
(Co) Concentration. in outdoor air	mg/m^3		0.00E+00
(b) Foundation attenuation factor	dimensionless	0.001	
(Fu) Flux for area under building	mg/sec-m^2		7.06E-04
(A) Area through which flux occurs under building	m^2	50	
(V) Volume of building	m^3	2440	
(E) Exchange rate of building air	bldg. vol./sec	0.000139	
(Ci) Total indoor air contaminant concentration	mg/m^3		1.04E-04

INTAKE (INHALATION) OF VAPOR PHASE

Intake = Indoor contaminant conc. (Ci) * Daily intake rate (IR) * Exposure time (ET) * Exposure freq. (EF) * Exposure duration (ED)/ Body weight (BW) * Averaging time (AT)

Variables	Units	Inputs	Outputs
ENTER 0 IF SOURCE IS UNDER BUILDING; ENTER 1 IF PAVED AREA DIRECTS VAPORS UNDER BUILDING.	dimensionless	0	
(Ci) Total indoor air contaminant concentration	mg/m^3		1.04E-04
(IR) Daily intake rate (See ref. 5 for default value)	m^3/day	20	
(ET) Exposure time	hrs/24 hrs	10	4.17E-01
(EF) Exposure freq. (See ref. 5 for default value)	days/yr	250	
(ED) Exposure duration (See ref. 5 for default value)	yrs	25	
(BW) Body weight (See ref. 5 for default value)	kg	70	
(AT) Averaging time	days		2.56E+04
Intake	mg/kg-day		3.03E-06

EXCESS LIFETIME RISK CALCULATION

EXCESS LIFETIME RISK = SLOPE FACTOR * UNITS OF EXPOSURE

Variables	Units	Inputs	Outputs
Carcinogenic slope factor (Potency factor)	1/mg/kg/day	0.01	
Units of exposure (Intake)	mg/kg/day	3.03E-06	
Excess Lifetime Cancer Risk	dimensionless		3.03E-08

SIMPLIFIED VAPOR PATHWAY EVALUATION AND INCREASED CANCER RISK ASSESSMENT CALCULATIONS

SITE NAME: Fullerton Bus Pk	12/14/95		
SITE ID #: 94IC29	RUN #: TCE - 2		
ANALYSIS BY: L. Lodrigueza	15' 1 layer		

SOIL PORE WATER

Soil gas concentration (Csg) = [Contaminant concentration in soil (Ct) / Wet weight soil moisture content (Mwet)] * Henry's Law constant (H)
(Note: When multiple soil layers are used in the flux calculation, be sure the soil characteristic values that are used below are from layer in which the contaminant (source) is located)

Variables	Units	Inputs	Outputs
(Ct) Contaminant conc. in soil (site data) (IF NOT USING THE SOIL PORE WATER COMPONENT, INPUT 0)	mg/kg	1.1	
Wet weight soil moisture content (Mwet) = Mdry / 1 + Mdry (calculated)	gram/gram		1.25E-01
Mwet (field data) (IF NOT USING SITE SPECIFIC DATA, INPUT 0.)	gram/gram	0	
(H) Henry's Law Constant	Dimensionless	0.3657	
Soil moisture by dry weight (Mdry) = Soil moisture by volume (Ø) / Bulk density (Bd)	gram/gram		1.43E-01
(Ø) Soil moisture by volume, (See ref. #4 for default value.) (Note: 1 cm^3 water = 1 gram water)	cm^3/cm^3	0.207	
Bulk density (Bd) = Particle density (Pd) - [Pd * Total porosity (Pt)].	g/cm^3		1.45E+00
(Pd) Particle density (Use 2.65 as default value)	g/cm^3	2.65	
(Pt) Total porosity (Use ref. 4 as default)	cm^3/cm^3	0.453	
Calculated soil gas level	mg/l		3.22E+00
Calculated soil gas level	mg/cm^3		3.22E-03

DISSOLVED IN GROUNDWATER

Soil gas concentration (Csg) = Concentration in groundwater (Cw) * Henry's Law constant (H)

Variables	Units	Inputs	Outputs
(Cw) Conc. in GW (IF NOT USING DISSOLVED IN GROUNDWATER COMPONENT, INPUT 0.)	PPM	0	
(H) Henry's Law constant	dimensionless		
Calculated soil gas level	mg/cm^3		0.00E+00

DIRECT MEASUREMENT OF SOIL GAS

Variables	Units	Inputs	Outputs
(Csg) Contaminant soil gas conc. (IF NOT USING DIRECT MEASUREMENT COMPONENT, INPUT 0.)	mg/m^3	0	
Spreadsheet unit conversion to mg/cm^3	mg/cm^3		0.00E+00

FREE PRODUCT

Conc. of soil gas (Csg) = Vapor pressure (VP)* Mol. Wt. (MW) * Mole fraction (MF) / Universal gas constant (R) * Absolute Temp. (T)

Variables	Units	Inputs	Outputs
(VP) Vapor pressure at 20° C (IF NOT USING THE FREE PRODUCT COMPONENT, INPUT 0)	atm	0	
(MW) Molecular weight	mg/mole		
(MF) Mole fraction	dimensionless		
(R) Universal gas constant	cc-atm/mole-°k		
(T) Absolute temperature	°K		
Calculated soil gas level	mg/cm^3		0.00E+00

FLUX

Flux (F) = Measured or calculated soil gas level / Vertical length of soil layer between source and surface (or next soil layer that has a dissimilar vapor permeability) (L1) / Diffusion coefficient for soil layer (De1) L1+(L2/De2)+...(Ln/Den) (NOTE: If flux for outdoor conc. is expected to differ from indoor flux, first calc. outdoor flux and enter results below in outdoor component section, then come back and calc. indoor flux.)

Variables	Units	Inputs	Outputs
(Csg) Soil gas level (Note: Program selected the lowest non-zero Csg from spread sheet for use)	mg/cm^3		3.22E-03
(L1) Vertical length of 1st soil layer between source and surface. If only one layer, enter data here.	cm	457	
(L2) Vertical length of 2nd soil layer. (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 0.)	cm	0	
(L3) Vertical length of 3rd soil layer. (IF ONLY TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 0.)	cm	0	
(De1) Effective diffusion coefficient layer 1 = Diff. coefficient in air (Da) * (Air filled porosity layer 1 (Pa1)^3.33 / Total porosity layer 1 (Pt1)^2)	cm^2/sec		3.70E-03
(Da) Diffusion coefficient in air (See ref. 2)	cm^2/sec	0.081	
(Pa1) Air filled porosity layer 1 = (Pt1) Total porosity layer 1-(Ø1) Soil moisture by vol. layer 1	dimensionless		2.46E-01
(Pt1) Total porosity layer 1 (Use ref.4 as default)	cm^3/cm^3	0.453	
(Ø1) Soil moisture by volume, layer 1 (Use reference 4 as default)	cm^3/cm^3	0.207	
De2 = Da * (Pa2^3.33/Pt2^2)	cm^2/sec		0.00E+00
Pa2 = Pt2 - Ø2	dimensionless		0.00E+00
Pt2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	dimensionless	1	
Ø2 (Use refer. #4 as default.) (IF ONLY ONE SOIL LAYER IS CONSIDERED, INPUT 1.)	cm^3/cm^3	1	
De3 = Da * (Pa3^3.33/Pt3^2)	cm^2/sec		0.00E+00
Pa3 = Pt3 - Ø3	dimensionless		0.00E+00
Pt3 (Use refer.#4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1)	dimensionless	1	
Ø3 (Use refer. #4 as default.) (IF ONLY ONE OR TWO SOIL LAYERS ARE TO BE CONSIDERED, INPUT 1.)	cm^3/cm^3	1	
(F) Flux	mg/sec-cm^2		2.61E-04

OUTDOOR AIR COMPONENT

Concentration in outdoor air (Co) = [Outdoor flux (Fo) * Downwind length of contamination (Ld)] / [Wind speed (u) * Height of box (h), e.g., height of doorway or ventilation system intake.]

Variables	Units	Inputs	Outputs
ENTER 0 IF OUTDOOR AIR COMPONENT IS NOT TO BE USED. HOWEVER, IF IT IS USED AND Fo ≠ Fi, ENTER CALCULATED Fo HERE. SEE NOTE IN FLUX SECTION.	mg/sec-m^2	0	
ENTER 1 IF Fo ≠ Fi, OR 2 IF Fo = Fi.	mg/sec-m^2	2	2.61E-04
(Ld) Down wind length of contamination	m	1.524	
(u) Wind speed	m/sec	0.894	
(h) Height of box	m	2.44	
(Co) Concentration in outdoor air	mg/m^3		0.00E+00

CONCENTRATION IN INDOOR AIR

Total conc. in indoor air (Ci) = Conc. in outdoor air (Co)+[Foundation attenuation factor (b) * Flux for area under building (Fu) * Area through which flux occurs (A)] / [Vol. of building (V) * Air exchange rate (E)]

Variables	Units	Inputs	Outputs
(Co) Concentration. in outdoor air	mg/m^3		0.00E+00
(b) Foundation attenuation factor	dimensionless	0.001	
(Fu) Flux for area under building	mg/sec-m^2		2.61E-04
(A) Area through which flux occurs under building	m^2	50	
(V) Volume of building	m^3	2440	
(E) Exchange rate of building air	bldg. vol./sec	0.000139	
(Ci) Total indoor air contaminant concentration	mg/m^3		3.84E-05

INTAKE (INHALATION) OF VAPOR PHASE

Intake = Indoor contaminant conc. (Ci) * Daily intake rate (IR) * Exposure time (ET) * Exposure freq. (EF) * Exposure duration (ED)/ Body weight (BW) * Averaging time (AT)

Variables	Units	Inputs	Outputs
ENTER 0 IF SOURCE IS UNDER BUILDING; ENTER 1 IF PAVED AREA DIRECTS VAPORS UNDER BUILDING.	dimensionless	0	
(Ci) Total indoor air contaminant concentration	mg/m^3		3.84E-05
(IR) Daily intake rate (See ref. 5 for default value)	m^3/day	20	
(ET) Exposure time	hrs/24 hrs	10	4.17E-01
(EF) Exposure freq. (See ref. 5 for default value)	days/yr	250	
(ED) Exposure duration (See ref. 5 for default value)	yrs	25	
(BW) Body weight (See ref. 5 for default value)	kg	70	
(AT) Averaging time	days		2.56E+04
Intake	mg/kg-day		1.12E-06

EXCESS LIFETIME RISK CALCULATION

EXCESS LIFETIME RISK = SLOPE FACTOR * UNITS OF EXPOSURE

Variables	Units	Inputs	Outputs
Carcinogenic slope factor (Potency factor)	1/mg/kg/day	0.01	
Units of exposure (Intake)	mg/kg/day	1.12E-06	
Excess Lifetime Cancer Risk	dimensionless		1.12E-08